Vol. 1—4

PAVING AND MUNICIPAL ENGINEERING.

A Journal Devoted Specially to Street and Sidewalk Paving, Water Works Construction, Bridge Building, Street Lighting, Sewerage and all Matters Pertaining to Public Improvement in Cities.

ONE DOLLAR A YEAR IN ADVANCE. INDIANAPOLIS, IND., SEPTEMBER, 1890. SINGLE COPIES, TEN CENTS.

J. E. RILEY, PRES., Omaha, Neb. C. W. HUBBARD, SEC., Sioux Falls, S. D. F. W. LITTLE, TREAS., Sioux City, Ia. A. D. TINSLEY, AUD., Sioux Falls, S. D.

THE

SIOUX FALLS GRANITE COMPANY LIMITED.

CAPITAL, $250,000

PAVING BLOCKS

Quarry and Works, Sioux Falls, South Dakota.

C. W. HUBBARD, GENERAL MANAGER.

Sioux Falls Granite

HAS AN ESTABLISHED REPUTATION as a FIRST-CLASS PAVING STONE FOR THE HEAVIEST TRAFFIC. IT HAS BEEN EXTENSIVELY USED in all the LARGER WESTERN CITIES with ENTIRE SATISFACTION. **180,000 Square Yards** *of Sioux Falls Blocks have been laid in Chicago during the last four years for TRACK AND STREET WORK.*

This Company is operating one of the largest and most complete plants in the country, and can fill orders promptly. Present output, 40,000 blocks daily.

General Office, SIOUX FALLS, SOUTH DAKOTA.
Omaha Office, 4 and 5 GRANITE BLOCK.
Chicago Office, 730 OPERA HOUSE BLOCK.

THE INDIANAPOLIS * * *

Paving Exposition

ALL cities in the United States are invited to send committees or official delegations to Indianapolis to avail themselves of the unequaled advantages afforded by the Exposition for gathering knowledge of paving.

EMBRACING

The Largest and Finest Collection of Specimens of Paving

IN THE WORLD,

WILL, on account of its value and beneficial influence in STIMULATING A SPIRIT OF PUBLIC IMPROVEMENT, be continued indefinitely under the management of the Commercial Club of Indianapolis, the organization which originated the idea and made the Exposition a success.

Exhibits of More than Sixty of the Leading American Paving Companies.

New exhibits are being added, and the Exposition will be enlarged and improved in every way possible. Companies not already represented are invited to send exhibits, but no paving material regarded by the committee in charge as being without merit will be admitted to the Exposition. Exhibits must, in all cases, be shipped with freight charges prepaid.

The assurance can be given that more can be learned about paving at this Exposition than by visiting a dozen of the best paved cities in America.

A two-cent stamp should be sent with requests for copies of the REPORT OF THE PAVING EXPOSITION.

For further information, address the Commercial Club, Indianapolis, Indiana.

M. S. HUEY,
GEO. N. CATTERSON,
WILLIAM C. BOBBS,
Paving Exposition Committee

Warren-Scharf Asphalt

Paving Company,

CONTRACTORS FOR

PAVEMENTS

Of Genuine Trinidad Asphalt,

The Ideal Pavement of Modern Times,
No Longer an Experiment,
Experience has Established its Superiority.

Over five millions square yards, equal to about 285 miles of street thirty feet wide, in successful use in over forty cities of the United States and Canada.
For full information and estimates apply to

WARREN-SCHARF ASPHALT PAVING CO.,

81 Fulton Street, New York,

or 23 BLYMYER BUILDING, CINCINNATI, OHIO.

A. H. PERKINS, President. W. D. HITCHCOCK, Vice-President. V. W. FOSTER, Sec'y & Treas.

THE WESTERN

PAVING and SUPPLY

COMPANY.

CONTRACTORS FOR

GENUINE TRINIDAD ASPHALT PAVEMENTS,

AND DEALERS IN

PAVING MATERIALS,

Room 7 Ingalls Block, INDIANAPOLIS.

OFFICE TELEPHONE 757.

S. H. SHEARER, Manager.

Yard & Works: Cor. Michigan & Indiana Ave. TELEPHONE 380.

PRINCIPAL OFFICE, CHICAGO, No. 8 The Rookery.

DETROIT OFFICE, Cor. Jefferson Ave. and Griswold St.

GEO. MOERLEIN, Pres. JNO. GOETZ, JR., V. P. J. A. EBERHARDT, Sec. Treas. & G'l M'r

THE Southern Granite Company

Estimates for Architectural, Monumental and Street Paving Work will be promptly furnished.

OFFICES:

19 and 20 Wiggins Block, CINCINNATI, OHIO.
20 Kimball House, ATLANTA, GA.

THOS. H. SPANN, President. JNO. G. PENDERGAST, Vice-President.

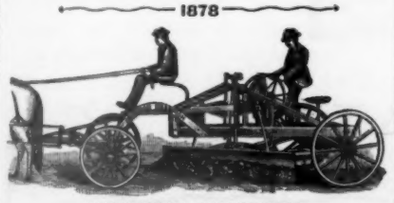
THE INDIANAPOLIS Paving Company

BRICK PAVING.

We handle the CELEBRATED HALLWOOD BLOCK.

W. A. RHODES, Secretary and Treasurer, 72 East Market St., Indianapolis, Ind.

1878



AMERICAN CHAMPION.

THE American • Road • Machine COMPANY,

OF KENNETT SQUARE, PENN., U. S. A.

1890

LIGHT STEEL CHAMPION.

Are the oldest and largest manufacturers of Improved Road Machinery in the world. Their line embraces Road Machines ranging in price from $100 to $250. Road Rollers, all sizes, Rock Crushers, Wheel Scrapers, Drag Scrapers, Railroad and Grading Plows and Contractors' Carts. Their American Champion was awarded the silver medal at the Paris Exposition in 1889. Endorsed by L.W. Rundlett, C. E. of St. Paul, Minn.; Russell Thayer, C. E. of Fairmount Park, Philadelphia, Pa.; J. I. Case, owner of J. I. C., and many others whose judgment is regarded as authority. Their Steel Frame Light Champion is as enthusiastically endorsed by its users as being the best light draft Reversible Machine made. Their Champion Machines this season won 119 out of 155 competitive trials. All their machines are fully protected by letters patent and any machines other than their make employing HAND WHEEL LEVERS or SHIFTING HIND AXLE infringe their patents. One suit now pending against such an infringer—The Western Machine. All intending purchasers will do well to correspond with the American Road Machine Company before buying elsewhere. Catalogues, testimonials and prices on application.

DO YOU MAKE PAVING BRICK?

The signs of the times point to a greatly increased demand for this class of ware
And a wise man is he who arranges to meet this demand and to

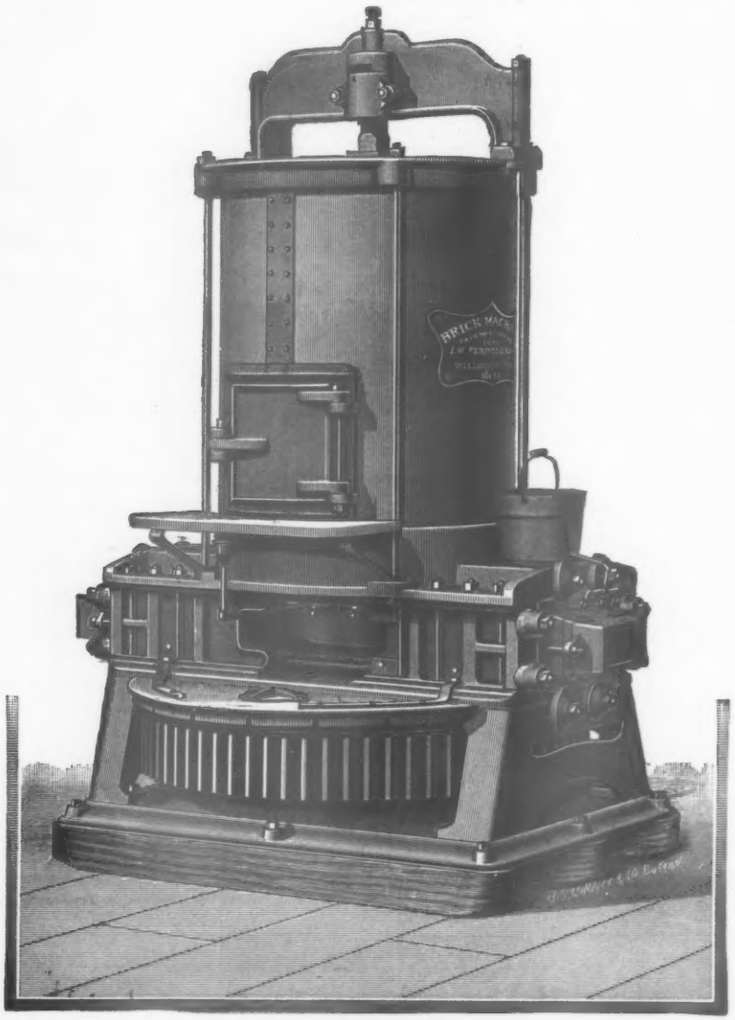
USE

The PENFIELD

Stiff Clay

Machinery
For Paving
And Building Brick

Complete Outfits
A Specialty.
Pug Mills,
Granulators,
Elevators,
Hoisting Drums, Etc



No. 15 "D" Brick Machine.

Upright

Stock Brick
Machinery, for
Sand Mold Brick.

Satisfaction
Guaranteed.
Clay Crushers and
Stone Separators,
Iron Dry Cars,
Turn Tables, Etc.

BRICK MACHINERY

WE MANUFACTURE CLAY WORKING MACHINERY OF ALL KINDS.

FOR CATALOGUES AND FULL PARTICULARS, ADDRESS

J. W. Penfield & Son, Willoughby, Ohio. U. S. A.

PAVING AND MUNICIPAL ENGINEERING

VOL. 1. INDIANAPOLIS, IND., SEPTEMBER, 1890. No. 4.

CONTENTS.

PAGE.

Improvement of Public Highways.....*J. J. W. Billingsley* 57
A New Highway Law for Tennessee..... 59
Sewerage.....*Andrew Rosewater, C. E., and Frank Chrysler, C. E.* 60
The Price of Asphalt Pavements..... 61
Asphalt Block Pavement.....*Walter S. Wilkinson* 61
Public Work in Grand Rapids..... 62
Germany's New Paving Material..... 62
Classification of Water Rates.....*C. N. Priddy* 62
Brick as a Paving Material..... 64
Infringement of Road Machine Patents..... 64
Filling a Want and Filling it Well..... 62
Street Cleaning in New York..... 62

EDITORIAL—
- A New Era of Road Improvement..... 63
- Contracts for Public Work..... 63
- Cities Without Sewerage..... 64
- Public Support of Water Works..... 64
- Notes..... 64

MUNICIPAL ENGINEERING NEWS—
- Paving..... 65
- Water-works..... 65
- Bridges..... 65
- Sewers..... 66
- Street Railways..... 66
- Street Lighting..... 66

IMPROVEMENT OF PUBLIC HIGHWAYS.

By J. J. W. Billingsley.

THE improvement of public highways is a subject of much importance, affecting, as it does, the general prosperity of the country. The marketing of farm products, the exchange of commodities, the social and educational advantages, and many of the enterprises and industries depend, to a considerable degree, for success, upon the favorable condition of the highways.

The good or bad condition of the roads has much to do with the general traffic of the country. The farmer living five miles from the nearest railway station, with a bad road to travel, will experience more difficulty in drawing thirty bushels of wheat to market, than another who draws sixty bushels a distance of ten miles over a well-improved highway; and the latter will travel the distance, possibly, in less time.

There is a business air attaching to the ability to harness up a span of good farm horses and hitch to a load of three or four thousand pounds and drive off to market with comparative ease, in contrast with the farmer who, with half the load and bad roads, goes twisting and turning to avoid the worst mud-holes, taxing the team to its utmost strength to get through, with all the whipping and hurrahing that can be done, finally reaching the point of destination with a jaded team and driver, with only a ton's weight at best.

It is exhilarating to the man who is so situated that he can take the lines in hand, tightened over a pair of good roadsters, wheel into the public highway from his own premises and hold steadily on the bits and make six or eight miles an hour to the town or village, over a smooth highway, without giving any thought as to the selection of the best track to travel, either side being alike good, with no obstructions to be avoided.

The extent of trade that any town or city may draw is dependent in part upon the condition of the highways leading thereto.

The town of A——, ten miles distant, may be reached with less difficult travel, with a full load, over a good road, than the town of B——, five miles distant, over a bad road, or a road that is barely passable, with a half load.

The town A—— gets the trade of a much larger area of country on account of the better roads leading to it.

The cost of getting produce to market over good roads, compared with bad roads, is diminished quite one-half—the loads drawn may be larger, and the power required to draw them less—the time is shortened and the wear and tear upon the team and vehicles is lessened.

Towns and cities having manufacturing and trade interests of any considerable extent may be dependent upon the country for regular supplies at reasonable prices.

If the roads are so improved as to admit of regular travel all the year round, the needed supplies will be forthcoming as the demand requires them.

The social and educational interests of any section of the country may be advanced or retarded very much by the character of the highways. Indeed, highways are indicative of the advancement in civilization attained by a people or nation.

The Indian had his trail, the early settler his blazed bridle path, then the meandering highway made along the ridges and over the more gradual sloping lands. They served their time, were traveled, and here and there improved and eventually established upon the lines dividing the lands.

Step by step, as the agricultural lands have been brought into cultivation, the roads have somewhat improved, until the time is at hand when the general prosperity of the country demands something substantial in the improvement of highways. Business foresight demands something better than the present temporary methods of "working roads."

I do not ridicule road supervisors for the character of the work already done. Much of the work has been superintended by men of practical sense, men who did the best they could with the means they had in hand. Those that performed the labor were their neighbors, who were alike interested, and over whom it was not expedient to exercise lordship, but whose advice, as a whole, it was better to heed, and thus promote the harmony of the neighborhood.

The road districts are usually large, and the amount of work needed being much more than the days and taxes assessed would allow. So it was judged that the best thing to do was to work the worst places. Dirt was dumped into mud-holes, and the roughest places smoothed a little, an obstruction here and there removed, and an occasional load of gravel was dumped into a low place, and temporary bridges and culverts span the draws and muddy streams.

This method embraces about all that can be done, with the present system. It is very likely that much of this kind of work has not been done in the best way, but it was thought to be best. Every man's hands have been full of his own work, and he was glad to get away from the road working when he had filled, in a temporary way, the requirements of the law.

But the conditions that surround us have changed, and a better system of road working is demanded, for the reason that it is one of the needs of the hour, if we would promote the general business prosperity of the country.

Railroads have brought markets near to us. Every surplus that we have will bring money, in its season, and it is important to market products in their season. Manufacturing interests are being established in the towns and cities; the vegetable and fruit products of the farm or garden have an added value; so that much depends upon our facilities for marketing them in their season.

We can no longer afford—if we ever could—to be locked up two or three or four months of the year, with impassable roads, or next to impassable.

The general business enterprise demands exchange, not only in products, goods and merchandise, each in its season, but a regular exchange of business and educational thought.

We can not afford to be practically idle in business relations three or four months in the year, on account of bad roads. What we want now is a general agreement as to the best methods of improvement and not opposition to an onward movement. Those who would avoid the expense will, doubtless, pay double the cost in the stagnation of business interests consequent from bad highways. Somebody must take the lead in every enterprise, and so it must be in road improvement, or the work will not be done.

First of all, we need a road law; a law providing for the election of road commissioners to hold their office for four years, at least. Such commissioners ought to be selected for their business capacity, and not for party affiliation—the latter, however, can hardly be yet in many localities.

The reason we name four years as the length of their term of office is, that they may have time to complete road improvements, without being deterred by the possibility of losing votes, by adopting the best methods of improving highways—they will have time to demonstrate the wisdom of the methods adopted.

The road commissioner should employ the labor and purchase the tools, machinery and supplies necessary for the work to be performed.

A county or township tax should be assessed of not less than—or more than—sufficient to employ the labor and purchase the needed machinery. Towns and cities should not be exempt, for the reason that benefits accrue to both town and county.

In the improvement of highways it is desirable to construct them, so far as practical, on straight lines. However pleasing curved lines may be in landscape engineering, yet, in the construction of highways, utility demands straight roadways, or as near so as is reasonably possible.

The slope or inclination of a road will have much to do with the character of the loads drawn over it, and also the speed of the ordinary travel. The greater the slope the greater the load and speed of travel. It may be well to ascertain the greatest and the least allowable grade.

Slopes have their advantages in the ready discharge of the surface water from the side ditches. One foot rise in 115 feet is considered the minimum slope necessary to secure needed surface drainage.

With a slope 1 ft. in 44 ft. to the mile a horse can only draw three-fourths of the load which he could draw on a level. On a slope of 1 ft. in 24 ft., or 220 feet to the mile, he can only draw half as much. And on a slope of 1 ft. in 10 ft., or 528 feet to the mile, only one quarter as much.

In the improvement of highways those having the work in charge neglect, frequently, to cut the grade down at points whe e it should be done, so as to allow an increase in the size of the loads to be drawn.

As an illustration: The loading of teams will be governed by the hardest pulls which occur where there are the greatest slopes or steepest hills, as we usually say, or where the greatest obstructions may exist—which may be mud-holes.

With the grading implements of recent invention the work of grading may be expeditiously done, and when done under the supervision of a competent road commissioner and hired help, may be performed when the condition of the soil and subsoil is most favorable.

The grading when completed should be so evenly leveled and compacted as to form a smooth travel way. It is folly to leave an uneven surface, and allow the travel to increase the depressions by working them into so many mud-holes. An uneven surface is an obstruction to the travel in the driest weather.

The travel-way should be slightly raised in the center, so as to allow the water of rainfall to pass off readily. The width of road-bed for ordinary roads need not be more than 16½ ft., sufficient for vehicles to pass each other with ease. Town roads may be 20 or 25 ft. wide.

The width should not be more than the travel requires. The width of a main road entering a large city might be 30 or even 40 ft. in width. But every added foot of roadway, more than is needed, kept in repair, is so much money wasted as may be required to pay for the labor.

If the principal travel-way is provided to be in the center of the road the middle soon wears into ruts, so that water will stand in the depressions, which, together with the action of the wheels, will wear into deeper depressions and even into mud-holes.

Where the road is raised too high in the center the wheels of vehicles will have a sliding tendency, which will wear both the roadway and the vehicle; the latter especially, where the roads are made of stone or gravel, and the labor of the horses is likewise increased; hence, the importance of a slightly curved road-bed, with travel-ways on each side of the center of the roadway, having side ditches to carry off the storm water

A dry road-bed is imperative in the construction of good roads—the foundation upon which to build. In our alluvial soils it will often be found expedient to lay one or two lines of tile at a depth of three or more feet to prevent the water from getting under the road-bed. Where the water comes from one side, on account of rising ground being on one side, then a single line of tile on the side of the rising ground may be sufficient. Otherwise, on land where the water may run under the road-bed from both sides, it will be better to lay two lines of tile, each line being laid on the inside of the open surface ditches on each side of the travel-ways, with outlets at lowest points. By so doing the foundation for a good roadway will be permanently provided for; if well done the improvement will never need to be repaired.

A graded road-bed well underdrained with tile, as above indicated, will not require more than half the gravel to make a good gravel road that will be required if the road-bed is not underdrained. Where the water percolates underneath the road, and rises by capillary action, until the surface gives way, then the "bottom drops out," and it never does drop out except when caused by the water under the road-bed—which may be prevented by sufficient underdrainage.

The underdrainage of highways, as suggested, which is, in fact, Mr. Elliott's plan of improving highways where gravel can not be had, has proved so satisfactory, that in many sections of the states of Illinois and Iowa they are adopting this method.

It is not only the best they can do for the present, but it is about all they can do, to underdrain and make a good grade. Then the mud never gets deep, and a fair load may be drawn at any season of the year.

By underdraining the road-bed sufficiently, and grading so as to prevent the accumulation of water on the surface and protect against the side wear of vehicles, our common roads may be made passably good at all seasons of the year. But the road will be better still if gravel is spread on the surface of the travel-way. The necessary bridges and culverts, to make the way complete, are included.

For culverts, large drain tile or sewer pipe—the latter at present prices is as cheap as tile and in localities where they can be readily obtained they should be used. The pipe should be laid so as to insure the passage of the water through, without filling the tile more than one-third full at a low stage of water, and have a

free flow away from the tile or pipe, thus preventing the freezing of the water so as to break the pipe. Culverts substantially constructed with pipe or stone, when well done, are a permanant improvement.

What has been said already as to the grading and underdraining of road-beds will suffice for the construction of gravel roads, and we only need to suggest two or three points from our own experience.

Gravel is better if mixed with a little earth to make it bind together. River or creek gravel is usually too clean, and the pebbles worn too smooth, by the action of the water, to make a solid road-bed. The mixture of a little earth-matter will often be found to make a bond that can not be had otherwise.

A coating of four or five inches of gravel spread over the road-bed, and then travel may be allowed to pass over it until it becomes compact; then a second coating of four or five inches evenly spread and kept in place by men watching with scrapers to fill up ruts and keep the grade perfect, will make a good road for common travel. If the road-bed has not been underdrained and is inclined to be seepy and wet, it will be better to add a third layer of gravel, and keep the surface smooth until the gravel becomes firm.

The writer deems it unnecessary to treat of the macadam system, which consists in the making of a solid road-bed as before described, and covering the same with broken stone. The stone broken fine and being angular in form they consolidate into a hard mass by the travel, provided the stone is of good quality. There is a great difference in stone as to wear. The same requisites are necessary in the macadam system, viz., a dry road-bed slightly curved surface, grade, etc.

In conclusion permit me to direct attention to the possibility of using vitrified brick in the improvement of highways where gravel and stone are not available for use. After we shall have graded our roads, and provided solid road-beds by the necessary underdrainage, an excavation of nine feet in width and five inches in depth might be made and the earth compacted firmly and made even on the surface; then hard pavers, or vitrified brick set on edge crosswise of the roadway as close together as possible, breaking joints the same as in building; the brick being tamped until firmly settled might then be covered with a slight layer of sand, which would fill all the interstices by the wear of ordinary travel. If sand can not be had, then a light covering of earth might do quite as well. At points two or three hundred feet apart the brickway could be widened so as to allow loaded teams to pass each other; otherwise, the earth travel-way being at the side, in all ordinary weather, would be quite as good for empty vehicles or light travel, allowing the loaded teams the right of way.

Would it be durable? Yes. In Holland where they have many of their principal roads paved with brick, they have been in use for fifty years or over, with very little repair. Prof. Roberts, of Cornell University, told the writer that in the famous Jersey Islands the roads are generally paved with brick, and they are the best roads. It may be said that they have cheap labor, and so they have; but when the necessity arises the Yankee's inventive genius gets away with cheap labor, by using machinery. It is probable that before another quarter of a century has passed by we will have cheapened the production of brick, so as to make the use of hard brick practicable in the construction of highways.

Leaving the matter of future speculation, we are confronted with the fact that we have not made the best use of our time and labor in the improvement of our earthen roads. We can grade and drain and gravel, and in this way put them in good condition for the greater part of the year, if we will go about the work with a better system.

The improvements in road machinery, the rapidity with which the work may be done, and the need, and advantages to be gained, all invite us to do earnest work.

We must have a law that croakers will respect; because by it they are prevented from stopping the work by objecting. And then apply civil service rules to those having the work in charge: when found competent, keep them at the helm.

We hardly appreciate the importance of the question until we look at it from all the standpoints.

If the highways of any good agricultural region were well graded and drained with permanent culverts and substantial bridges, does any farmer question that the value of the land would be increased from five to ten dollars per acre, on account of the better market facilities, the increased business enterprise, and the social and intellectual advancement that would result from work well done in this line. This increase in value would not cost to exceed 50 cts. per acre.

But to do this the old system of doing things must be abolished, and the people convinced that the benefits arising will be more than commensurate with the cost.

A NEW HIGHWAY LAW FOR TENNESSEE.

DR. Olin H. Landreth, of Vanderbilt University, has for four or five years been giving thought to the subject of a proper highway law for Tennessee, and has prepared a bill for the consideration of the Tennessee Road Congress, of which the following is a synopsis:

The public road and bridges of each county of the state shall be under the care and control of a county board of highway commissioners, comprising three members, of whom the county judge or chairman of the county court shall be ex-officio the chairman of the commission. The remaining two commissioners shall be resident free-holders; they shall be elected by the county court and shall hold office for four years or until the qualification of their successors. The commissioners first elected after the passage of this act shall hold office until January, 1892 and 1893, the order to be indicated by the county court at the time of their election. Thereafter one commissioner shall retire at each January term of the court and a successor shall be elected.

The board of commissioners shall hold regular meetings at least once each month, and special meetings at the call of the chairman, who shall issue such call at the written request of one member. At all such meetings two shall constitute a quorum. The transactions of all meetings of the board or its agents shall be regularly recorded by a secretary chosen from among the members, and shall be permanently preserved in the county records, and in a form prescribed by law.

The commissioners shall be required to give the whole, or so much of their time as may be required to conduct efficiently the business of the board, and in compensation they shall receive either a fixed salary or a per diem allowance and necessary expenses, the amount of which shall be determined by the county court, but no alteration in the salary or rate per diem for any commissioner shall be made during his term of office.

The first business transacted by the board of commissioners after its election shall be the selection and appointment of a competent, experienced civil engineer, who shall be paid a regular salary and a stated amount for expenses, the amount of which shall have been determined by the county court prior to his appointment, and such engineer shall be required to devote his whole time to the business of the board of commissioners, provided this shall not prevent two or more counties from engaging the whole time of such an engineer in common. The amount of time he shall devote to each county, and the compensation from each, is to be determined by a joint meeting of the board of commissioners of the several counties interested. Such engineer shall be termed "the county engineer of roads and bridges," and it shall be his general duty to advise the board on all technical questions pertaining to the business of the commission, to act as the authorized agent of the commission, to prepare and preserve permanent maps and records of all roads in the county and of all work, improvements and repairs done on said roads, together with a record of the cost of performing each portion of the same, to aid in the assessment of taxes for roads and bridges, and to prepare and submit to the board plans, specifications and costs of all work contemplated. It shall be the first duty of the first engineer to submit to the commission maps of all the roads in his county, together with such

notes or information regarding travel on them, their present condition and their importance.

Thereupon the commission shall classify all roads into three classes: First, all the more important roads of the county and such as connect large towns or such as have the greatest amount of long distance travel. The second class shall include all roads such as connect the first class or receive the principal feeder to them, or such as receive the greatest travel between adjacent districts. Class third comprises those purely local in importance. Such classification shall be subject to the approval of the county court and may at any time be altered to suit the altered conditions of travel or the importance of the roads.

The county shall be divided into districts by the commission. The immediate charge of roads and bridges in these districts shall be in the hands of a district overseer of roads and bridges, who shall be appointed by the county engineer and who shall direct his whole time to superintendence of the roads of the first and second class

---

SEWERAGE.

By Andrew Rosewater, C. E., and Frank Chrysler, C. E.

THE sewerage of cities, as developed by modern art, is usually provided for, according to one of three distinct methods.

I. The disposal of all storm water entering or falling upon the surface of the city, through underground conduits. This is termed the storm water system.

II. The disposal of storm water on the surface of the streets, and of excremental and liquid house waste to some safe outlet through underground conduits, usually clay or cement pipes; this is termed the separate system.

III. The disposal to some suitable outlet of both the rain water and house sewage through the same underground conduit. This is called the combined system.

The conditions of each locality must be thoroughly considered before a safe conclusion can be reached as to the system of sewerage most suitable to it. There is no such thing as the best system in a general application of that term. The configuration of each locality, its soil, climate, population, wealth, and proximity or remoteness to some suitable outlet, are features that must be well considered in each case before a reliable conclusion can be reached. It often happens that different portions of the same city require different systems of sewage disposal. Engineers who advocate one system exclusively are like quack doctors who advocate the same medicine for all diseases.

The capacity of sewers varies with their size and the grades upon which they are laid. A sewer two feet in diameter on a grade of 15-100 feet per hundred will not discharge any more than a one foot sewer on a six foot grade, and on the other hand a one foot sewer on a grade of three-tenths per hundred will discharge only one-half as much as it will on a grade of one foot per hundred. To determine the size of a sewer it is therefore necessary to know the amount to be discharged and the grade upon which it can be laid.

The amount to be discharged by a sewer depends, first, upon the system adopted. If a storm water system, then it must be capable of discharging all the surface water as fast as it is liable to come during a storm; the quantity varying with the soil, paved area, etc. Some soils will absorb a large part of the rain as fast as it falls, others will shed it. A paved area absorbs less than an unpaved. For the purpose of explanation, assuming that none is absorbed, and all the water reaches the sewer as fast as it falls, then the quantity to enter a sewer would be completed by multiplying the area of the territory drained by the depth of rainfall. A square acre of ground, if covered by one inch of rainfall per hour, will discharge about 27,000 gallons per hour, and a square mile will discharge over 17,280,000 gallons per hour—so that if it rains on a square mile of surface at the rate of one inch per hour a sewer to carry that off must be able to discharge 17,000,000 gallons per hour, and its diameter will depend upon the grade on which it is laid.

If the system is a separate one, then the sewer must be large enough only to carry off the liquid house waste. This usually varies with the season, being greater in hot than cold weather—it will vary from forty to one hundred gallons per head of population in twenty-four hours. Hence it is necessary in this case to determine the probable future population per acre, and from that and the number of acres covered the quantity to be provided for can be determined. Thus 100 gallons per head and 100 people per acre (both of which are exceedingly high estimates), it would be necessary to provide a sewer capable of carrying at least $100 \times 100 = 10{,}000$ gallons per day for each acre of the town area. Again, if the system is the combined one, then both the first and last conditions must be considered in determining the size of sewers.

As some material entering a sewer is liable to be undergoing decomposition at the time of entry, gases to a limited extent will form. The sewers should have a current of fresh air constantly passing through them, thus diluting the gas sufficiently to render it harmless. To prevent the accumulation and consequent decomposition of other waste matters entering sewers, it is desirable also to give the sewer a thorough flush one or more times each day, and thus sweep all sediments before it to its outlet. The proper arrangements for doing this are best determined by expert engineers, who, as in the determination of sizes of sewers, will compute everything upon reliable data. Nothing in a well devised sewer system should be guessed at. The employment of competent and experienced engineers to devise plans and determine the system most suitable to all existing conditions will save thousands of dollars from being wasted, and often prevent sickness and death by precautionary measures for sewage disposal and sewer ventilation. The tendency of town boards to get competitive bids from "Tom," "Dick" or "Harry," regardless of competency, upon plans of sewers, and to hire the cheapest, often leads to very costly experience. What man of sense would, if sick and in need of skillful medical treatment, send out a circular or advertise for indiscriminate bids to ascertain who would render such services for the least money? Yet is it not equally ridiculous to call upon every surveyor or inexperienced engineer to make a proposal to furnish plans for a system of sewers which, if improperly designed or executed, is sure to entail not alone great financial loss, but endanger the health of a whole community?

What matters an expenditure of a few hundred dollars more upon plans, if in doing so the enterprise is made an assured success and the people are saved from the dangers of an ill devised and poorly constructed system of sewers?

A striking example of wasteful economy is shown in the sewer construction of a leading California city, where an ill-designed sewer outlet which cost $65,000, was condemned as a nuisance last year. This was built less than three years ago. If this plan had been submitted to *competent* engineers, a few hundred dollars expended on first-class professional advice would have saved one hundred times the amount in wasteful construction. Less than three hundred dollars paid a member of our firm for a review of the sewer plans in a leading city of Kansas, saved that municipality nearly $20,000.

The cost of complete plans and specifications for sewer systems necessarily varies with the difficulties of each case and the extent of territory for which details are to be drawn. This will range from $500 to $5,000. Preliminary reports embodying an outline of the salient features with an approximate estimate of the cost of the sewerage of a specific area are made at prices ranging from $300 to $500. This is often an advantage where funds are not at hand and a proposition involving the issue of bonds must first be submitted to the people. Such a proposition, to meet with favor, must be based upon reports and estimates of engineers of established reputation, in whom the public has confidence. Such a report involves an examination of the ground and surroundings, and sufficient surveys to enable the engineer to know the areas and slopes of the territory to be sewered.

THE PRICE OF ASPHALT.

THE committee on streets and alleys of the Kansas City common council has submitted the following report on an ordinance to fix the maximum price at which contracts for laying asphalt pavements in that city shall be awarded:

"We have corresponded with fifteen cities, receiving replies from twelve. In seven of these there is no competition, and as a result the price for same range from $2.50 to $5 a square yard—the Vulcanite Paving Company doing the work in Philadelphia at $2.50 without competition. In Washington the price is restricted by law to $2.25. Four companies are in competition in Boston, but most of the work is now being done by Caleb R. Ayer at $2.50. We have attempted to obtain from the Western Paving and Supply Company of Chicago and the Vulcanite Paving Company of New York an expression of a desire to compete with the Barber Asphalt Company, but have signally failed. The former company made reply to our first communication, but no answer has been received to a second letter written them. The Vulcanite Paving Company was written to twice, but beyond a reply that the first letter was not received, nothing further has been heard.

"We believe that asphalt paving can be laid in Kansas City at $2.65 and the company doing the same derive a reasonable profit.

"By advice of the city counselor we recommend indefinite postponement of the ordinance No. 6,558 and the adoption of the accompanying substitute resolution."

The resolution provides that $2.65 be the established price for pavement equal to the best laid in Kansas City prior to January 1, 1890, and for the same depth of base and thickness of the wearing surface.

The first proposed ordinance limited the price to $2.50 a square yard and provided a fine of from $500 to $5,000 for the city engineer or members of public improvement committees who awarded an asphalt paving contract at a greater price.

The schedule submitted by the committee contains the following information:

New Orleans pays $3.25 to the Barber company; twenty years' maintenance of paving; no competition; six miles in use.

Baltimore, $2.50 to the Maryland Paving company; two years' maintenance; no competition.

Buffalo, $3 to the Barber company; five and eight years' maintenance; no competition.

Omaha, a scale of $2.98, $2.68 and $2.48 to the Barber company; five years' maintenance; no competition.

St. Louis, $3 to the Barber company; nine years' maintenance at fifty cents a year for each square of one hundred yards; no competition.

Chicago, $3 to the Barber company and the Western Paving and Supply company; five years' maintenance; twenty-three miles of asphalt.

Washington, $2 and $2.25 to the Barber company and the Cranford Paving company; five years' maintenance.

Topeka, $2.80 to the Barber company; five years' maintenance; no competition; 193,600 square yards in use.

Boston, $2.47 to $3.50 to the Barber company; $3, $2.50 and from $2.25 to $2.70 to other companies; five years' maintenance.

Philadelphia, $2.50 to the Vulcanite Paving company; three years' maintenance.

New York, $3.33 to $4, and $3.50 to $5, on a five and fifteen years' maintenance, respectively.

ASPHALT BLOCK PAVEMENT.

To the Editor of Paving and Municipal Engineering:

SIR—Your valuable and admirable issue for August is just to hand. In publishing the report of Director of Public Works Wagner, of Philadelphia, you have done a great injustice in thereby spreading a maliciously false statement about asphalt block pavements. Director Wagner is one of those extraordinary men who can see what he wishes to see, and be at the same time absolutely blind and oblivious to those things he does not desire to see. We admit that asphalt blocks were very defective in their first years, and we do not claim that they are perfect yet, but we do claim that they form, as now made and laid, and as they have been made and laid in Washington, Baltimore and other cities for seven years past, the most desirable and relatively economical light-traffic pavement yet produced. I inclose a printed copy of a letter from Captain T. W. Symons, corps engineer United States army, with reference to Wagner's statements, which were submitted to him by Mr. Taylor, our representative on the Pacific coast, where these false statements seriously injured us. We were advised by eminent counsel that we had ground for an action for heavy damages, but concluded it was best not to enter into a legal contest, which would be protracted and annoying, and greatly interfere with the proper prosecution of our interests, and very likely result in nothing but a *verdict* in our favor. Since Captain Symons's letter was written we have laid in Washington more than sixty thousand square yards of asphalt block pavements, and we have every assurance that we shall receive orders for a very large amount within a few days, when the awards for 1890–91 are made. I ask that as an act of simple justice you give Captain Symons's letter insertion in your journal, in an equally conspicuous place with that in which Wagner's false statement was published. * * *

I beg to add a word with reference to the many glowing and enthusiastic statements in your paper about asphalt having been found in Colorado, Utah, Kentucky, etc., etc. Allow me to say that I have been steadily engaged in the asphalt business for ten years, that I have mined asphalt or chapopote, in Cuba, have seen it dug from the Trinidad lake, have handled a quantity from Venezuela, and have personally superintended the refining of many thousands of tons of various kinds of asphalt; that I have seen specimens of so-called asphalt from California, Colorado, Utah, Wyoming, Kentucky, Alabama, etc. I say so-called, because none of them are true asphalts; they are merely heavy vicious petroleums, in some cases distributed through the interstices of sand or sand rock, in one case of an earthy material, principally comminuted quartz, but not one of them has any claim to be called asphalt, and particularly not to be compared with Trinidad Lake Asphalt, which is more tenacious, tough and adhesive, than any asphalt thus far discovered to my knowledge.

Very respectfully your obedient servant,

WALTER S. WILKINSON.

Baltimore, August 14, 1890.

The letter from Captain Symons, referred to by Mr. Wilkinson, is addressed to Mr. C. B. Taylor, of East Oakland, Cal., and reads as follows:

MY DEAR SIR—Yours enclosing newspaper slips received. I am surprised at the statements of Director Wagner, of Philadelphia, which, however true they might have been at one time, are not true now. Many of the earlier asphalt block pavements were failures due to various causes thoroughly understood by those familiar with the subject. These causes have been almost completely removed, and an asphalt block pavement can be laid to-day which is of a very high degree of excellence.

During the past two years there have been laid in the streets of Washington, D. C., on my recommendation and under my supervision, fully 100,000 square yards of asphalt block roadway pavement. This gives good satisfaction, and was laid notwithstanding old failures, because the manufacture of the blocks had been radically improved. Asphalt block pavement, if as good as that laid in Washington, will give perfect satisfaction where laid on streets of moderate traffic. I quote from my last annual report published to the Engineer Commissioner of the District of Columbia, under date of September 29, 1888:

"The asphalt block pavements laid last year have developed remarkably good qualities. The method of manufacture and proportion of ingredients have been changed, so that to a very great extent defects in asphalt block pavements previously laid have been remedied. Under the influence of the summer heat and travel the blocks have softened and cemented together so as to form a pavement difficult to detect from one of sheet asphalt.

"These pavements turned out so well that a large amount will be laid during the year 1888–89."

I have seen no reason to change my opinion since writing the above, notwithstanding the very highly-colored statements of Director Wagner. [Signed] T. W. SYMONS.

PUBLIC WORK IN GRAND RAPIDS.

THE annual report of Mr. H. A. Collar, the civil engineer of Grand Rapids, shows that the expenditures for public improvements in that city during the last fiscal year were as follows: Street improvements have cost $80,800; sewers, $10,698.30; bridges, $1,314.50; bridge repairs, $2,752.67; water-works, $125,918.15; parks, $1,174.49; total, $222,658.11. Speaking of contemplated improvements, Mr. Collar says: "There is a manifest desire of our citizens to have our streets improved in the future in a more substantial manner, and, although the first cost of the improvement will be greater, it will, no doubt, be more economical in the end, owing to greater durability and less expense for repairs."

The water supply of Grand Rapids was, until recently, obtained from two small streams, called Coldbrook and Carrier Creeks. Increased population and contamination have made it necessary to abandon the creeks, and the city has constructed filter beds in the center of Grand river, from which the supply is now obtained. The city engineer says: "The new filter was made by excavating the rock bed of the river to a depth of five feet. In the center of the excavation are three collecting galleries 24 by 24 inches inside measurement, constructed of hemlock fencing, each course separated by one half inch strips placed one foot apart. The galleries are covered by two courses of plank laid with close joints. The galleries are joined together at the lower end and a conduit, three by three feet, leads to a new and larger pump-well near the pump-house. After the galleries were placed in the bottom of the excavation the pit was filled with broken stone and gravel of several grades in fineness, commencing with the coarsest at the bottom and ending with the finest on the top. The work was completed and the water turned in about the first day of October, 1889. The construction of the filter bed, as well as using Grand river as a source of water supply, has caused considerable discussion pro and con by the press and citizens of the city. To show that a river supply is a common one, the following statistics taken from compilations on the subject, are given: Number of cities containing a population of twenty thousand or over, 166, with an aggregate population of 16,660,000. Number of cities supplied by rivers only, eighty-three, containing an aggregate population of 8,889,500. Number of cities drawing their supply from rivers, creeks and brooks, twenty-nine. Number whose supply is taken from wells, galleries, surface water, etc., fifty-four. This does not show that a river supply is the best that can be obtained, any more than the arguments of directly or indirectly interested persons against such supply, prove that it is the worst."

GERMANY'S NEW PAVING MATERIAL.

THE *Schweizerische Bauzeitung* gives an account of the invention of a new paving material which is expected to take the place of asphalt. The chemists of Germany have heretofore made many attempts to make a substitute for asphalt, but always without success, the composition in every instance lacking the necessary strength and elasticity. Herr Busse, a chemist of Linden, near Hanover, noticed that all artificial asphalts lacked certain gummy oils existing in the natural stone. This led him to experiment on mixtures of finely powdered stone with these oils, with the result of producing a material said to be very similar to natural asphalt.

The material is claimed to be absolutely impervious to the action of the weather. At the Government testing bureau at Charlottenburg the compressive strength was found to be about 2,300 lbs. per sq. in. In some experiments in Hanover, it was found that a layer of the material two inches thick would stand a pressure of 5,970 lbs. per sq. in. The difference between this figure and that just given is probably due to the fact that the government tests were made on centimetre cubes. About 500 sq. yds. were laid in Hanover in the summer of 1887; this surface has worn so well that 1,670 sq. yds. are now being laid in that city. Berlin, Hamburg and Cologne have begun series of tests also. The compound is laid in a similar manner to asphalt. For streets, a concrete foundation eight inches thick is laid, and on this enough of the hot powder is spread to leave a two-inch layer when well rolled.

CLASSIFICATION OF WATER RATES.

By C. N. Priddy.

ON January 3 I sent out a circular to 1,500 cities in the United States asking for their water rates, etc., to which I received about 1,000 replies, and was very much surprised at the wide difference and manner in charging for water. Hardly any two are anywhere near alike, and after examining them I have come to the following conclusion: To begin with, in my opinion the only just and equitable way to sell water is by meter measurement, but for various reasons in a great many places it is not practicable. As circumstances are so different in all places, I will only try to treat of those rates that are of the most importance and in which there is the widest difference.

The family and dwelling-house rate is the most important of all. I think it should be charged by the occupancy or the number of persons using water. Also, closets and bath tubs should be proportioned the same. I do not think there should be any extra charge for hot water or the fixtures for same, or any extra charge for sinks, wash-stands or extra faucets, as all these are conveniences and are not supposed to take any more water, as all persons are supposed to use all the water they need regardless of the convenience. As for urinals self-closing, I think the rate should be about one-half that of the closet. For urinals constantly running, which I consider one of the greatest water wasters we have to contend with, the rate should be from two to eight times as much as closets, according to closet usage. And I think a wide distinction should be made between good and poor fixtures of all kinds, especially in water closets, as some poor ones will waste more in a day than a good one will use in a month. Therefore, it will be an inducement for parties to put in good plumbing and fixtures, which will be quite a saving to the water companies in the way of waste water.

FILLING A WANT AND FILLING IT WELL.

PAVING is the title of a new paper "devoted especially to street and sidewalk paving, water-works construction, bridge building, street lighting, sewerage, and all matters pertaining to public improvement in cities." It is issued from Indianapolis, is well edited, and the special articles are written by a corps of men who understand their subjects, and with these it is well supplied. Its advertising pages show that it is filling a want, and its editorial pages show that it is filling it well. William Fortune is editor, and while he is tempting the fickle dame, we hope he was born with a silver spoon in his mouth, so to speak. It is altogether a felicitous and fortunate conception.—*Millstone.*

STREET CLEANING IN NEW YORK.

A NEW method of street cleaning has been recently tried in New York City. After the street was swept, a stream from a fire engine was applied to thoroughly wash the surface of the street. The results were not satisfactory from any point of view. The muddy water collected in puddles in the hollows of the paving, while the amount of sand and silt washed down the sewers threatened to soon choke them up, and also to so fill the ferry slips and docks into which they discharge as to require constant dredging. Good paving and efficient sweeping are evidently essential to clean streets.—*Engineering News.*

PAVING AND MUNICIPAL ENGINEERING

A Journal Devoted Specially to Street and Sidewalk Paving, Sewerage, Water-Works Construction, Street Lighting, and all Matters Pertaining to Municipal Engineering.

Published on the 15th of Each Month.

WILLIAM FORTUNE, Editor. - - - WILLIAM C. BOBBS, Business Manager.

OFFICE: ROOM 44, CHAMBER OF COMMERCE, - - - INDIANAPOLIS, IND.

Entered at the Post-office, Indianapolis, Ind., as second class matter.

SUBSCRIPTION: { One Year, ... $1 00. Single Copy, ... 10.

Advertisements to insure publication should reach the publication office not later than the 5th of the month.

Communications are invited, and all requests for special information on the subjects treated by this journal will receive careful attention.

Articles relating to the different branches of municipal engineering are desired. Stamps should accompany manuscripts for return postage if unavailable.

The publishers of PAVING AND MUNICIPAL ENGINEERING *have been sending, each month, several thousand sample copies of the publication to persons supposed to be interested in the subjects to which it devotes attention, and will continue to do so indefinitely, the results in the marvelous increase of our list of subscribers having fully warranted the expense of this gratuitous circulation. It can not be expected, however, that more than one copy will be sent to the same person. We shall regard it as a favor if readers will send us the names and addresses of persons who may be interested in the publication.*

A NEW ERA OF ROAD IMPROVEMENT.

THE people of America have given evidence, by their patient compliance with exacting laws, which have imposed burdens greater than the benefits derived from their operation, that they are not lacking in appreciation of the importance of good roads, but they have been slow to learn better ways of securing them. Throughout the settled portions of the country state laws have long required that every able-bodied or property-owning township resident—the conditions of requirement varying some in different states—shall, each year, contribute a certain amount of money or devote so much labor to the improvement of country roads. The improvements made in pursuance of this system have been but temporary. The work has been done under the supervision of men who have had little or no practical knowledge of road-making, and usually they have no other idea of what should be done than that ruts should be filled. The work has been largely, as a matter of necessity, of the most superficial kind. The best roads have been those which have been maintained under the toll system, and they have not been all that they should be.

A general awakening to the importance of a better system of making and maintaining county roads has resulted in the inauguration of a movement which is very rapidly spreading, and promises a new era of improvement throughout the country. It is educational in character, and such it should be, for there can be no marked improvement in highways until the people who do the work and have supervision of it learn better ways of doing it than they now know. The new movement first took the form of organization when a Road Congress was held in Georgia, where there is direst need of better highways. A similar assembly is now about to be held in Tennessee, and the idea has been improved upon in some other states. Dr. Olin H. Landreth, of Vanderbilt University, has prepared a bill for submission to the Tennessee legislature, an abstract of which will be found elsewhere in this issue.

In Pennsylvania by legislative enactment a State Road Commission has been created, and is now traveling over the state, taking testimony upon the subject of highway improvement, preparatory to framing a new state law. New York has a voluntary organization known as the State Roads Improvement Association, which is spreading over the state and accomplishing much good through local agitation. The organization there is very largely the result of the labors of Mr. William A. Sweet, of Syracuse, the president of the association, who has prepared a bill, which the next legislature will be urged to pass, providing for a State Board of Highway Commissioners, and for the construction, under the direction of the state, of about 3,000 miles of good roads connecting the different county-seats. It will also require the supervisors of each county to raise enough money by direct taxation to construct a certain distance of good road each year.

These advanced steps toward improvement, and the growing sentiment throughout the country in favor of the construction of better highways, stimulated by the generally-felt need of them in the development of prosperity among agricultural producers, will doubtless result in desirable legislation in nearly all of the states within a few years, and America may then in time have as good roads as the countries of Europe.

CONTRACTS FOR PUBLIC WORK.

THE cry is often started, chiefly for political effect, that improvement work in cities should be divided so as to give "small contractors" a share in the benefits of public expenditures. It is a demand that is palpably in the interest of the class to whom the money is to go, rather than in the interest of the class from whom it is to come. It is in line with the idea that public contracting is "fat" business, and that all who have claims on political favor should be given a share without much regard to efficiency, or without requiring strict compliance with customary business principles. When municipal business is not managed just as private business should be, there is abuse of the trust of tax-payers and public interests are very sure to suffer. It is the duty of municipal officers to make the best possible contracts for public work, without consideration of the interests of contractors, large or small. They are expected to look after public interests alone, and to do it without attempting to mix with it the administration of charity. The city of Duluth, Minn., has had some experience with the demand for a division of improvement work into small contracts, with a view to enabling men of small capital to compete. The Board of Public Works has

given the matter some attention, and has reached very sound conclusions which are set forth in an official report to the Duluth common council, as follows: "In many cases this can not be done without greatly increasing the cost of the improvement. As the work is paid for by the holders of property benefited, it would be a manifest injustice to them to unnecessarily increase the cost. When a contract can be divided without prejudice or serious inconvenience, the board sees no reason why it should not be done; and they have hitherto endeavored to make such divisions as in their judgment could well be made. So far as our so called 'small contractors' are concerned, however, the experience of the past three years would seem to indicate that the wisdom of engaging in the business of contracting, whether on a *small* or a *large* scale, without ample capital to carry on the work, is extremely questionable, and the undertaking of it has proved disastrous in many cases to all parties interested. It is certainly better for the laborer upon our public works (and he is the principal factor in the matter whose rights are entitled to protection) to know that he will receive his wages promptly and in full, than to work with uncertainty in a matter so vital to him. Though the city requires a bond from contractors to protect labor, it is usually necessary to maintain an action for recovery, and vexatious delays, as well as losses, are likely to occur in any event."

IN view of the defective sewerage systems in many American cities, and the entire lack of sewerage in some places where there is large population, it is very remarkable that there are so few disease epidemics in the country, and that the death rate is so low. It is shown by recently gathered statistics that of 1,366 cities and towns in America only 466 have sewerage and 84 are partially sewered. These statistics do not, of course, include all of the cities of the country, the showing of which would not be near so good as from those that voluntarily report on the questions sent to them. Of the towns that are without sewerage, thirty-three have a population of more than 10,000, ten of more than 15,000, seven of more than 20,000, and eleven of more than 25,000, the latter being Dayton, O.; San Antonio, Tex.; Mobile, Ala.; Knoxville, Tenn.; Galveston, Houston and Austin, Tex.; New Albany, Ind.; Auburn, N. Y.; Lexington, Ky., and Joliet, Ill. Some of these cities have, however, taken steps toward securing sewerage systems, and the question is being agitated in all of them. Many of them are hampered by legislative or financial limitations, which are in some instances fostered and upheld by the always obstructive spirit of individual parsimony. Where the latter controls, the importance of sanitary precautions is never appreciated till the extreme penalty of neglecting them is experienced, as it was, for instance, in the city of Memphis.

IT has been too well demonstrated to be longer doubtful that, if properly managed, a city can supply water and light to its inhabitants at lower rates than private companies are, as a rule, willing to accept, but there may be some doubt as to how public support shall be given to such enterprises. The question is now up for consideration in Detroit, and the people there are trying to determine what proportion of the expense of their water-works should be borne by the consumers and what by the taxpayers in general. A council committee has recommended that the charges should be fixed so as to require the consumers to pay two-thirds of the operating expenses, including the interest on the bonded debt, and that the remainder be raised by general taxation. Inasmuch as there are general benefits derived from a water-works system by a city, it is argued that, where the works are owned by the city, some part of the expense of operating them should be borne by the city generally, including all the taxpayers who are consumers and those who are non-consumers. If the argument is accepted as good, we are at once confronted with a problem very difficult to solve—that is, to determine what proportion of the expense should properly be borne by the taxpayers generally. If the principle is recognized as right, consumers in cities where water-works are owned by the city will be able to get their water at much lower rates than under the old system, and it will probably aid in popularizing public control of water-works.

THE next issue of PAVING AND MUNICIPAL ENGINEERING will contain a valuable and interesting article by Mr. James W. Howard, C. E., on "The Paving Problem —Importance, Methods, Materials."

BRICK AS A PAVING MATERIAL.

WITHIN the last five or six years inventive genius has produced very remarkable improvements in the qualities of paving bricks, now commonly called paving blocks, and new methods of laying the material have been devised, with results which must be agreeably surprising to people who ignorantly suppose that a brick-paved street is something like the ordinary brick sidewalk. Paving blocks are now made which have density and hardness almost equal to granite, while they have the decided advantage of a smoother surface. It makes a great difference as to what kind of paving blocks are used, and how the work is done. There are good and bad kinds of brick. The kind may be approved and still the bricks may not all be good, as there is difficulty in burning all to the same degree of hardness. Vigilant supervision of the work at all stages of progress is necessary to secure the best work, but very good paving may certainly be done with brick. As a material it will, if properly selected and put down, wear longer than asphalt. If the work is done right it will make as smooth a pavement as wood block. In cost it is cheaper than asphalt and granite, the prices varying according to the distance that the materials are transported. The cost, however, should be of secondary consideration, as the differences in merit and service are proportionately much greater than the difference in some kinds of material. —*Indianapolis News.*

INFRINGEMENT OF ROAD MACHINE PATENTS.

THE United States District Court, of Illinois, has rendered a decision favorable to the plaintiffs in the patent infringement suit of the American Road Machine Company against Goulds & Austin, of Chicago. The plaintiffs have been granted a perpetual injunction against the defendants, which applies to the Austin Reversible Machine, and they will be entitled to remuneration for the damage done by infringement on their patents. Towns and others owning the Austin Machine will be compelled to stop using it unless they pay damages.

Paving and Grading.

West Main street, Norwalk, Ohio, will be paved with brick.

Twentieth street, Omaha, Neb., will be paved with wood.

Oakland avenue, Milwaukee, Wis., will probably be made a boulevard.

Champaign, Ill., has ordered the paving of three of the principal streets.

Stone and brick pavements are to be put down on several streets in Jamestown, N. Y.

Wilson & Thatcher have a contract for paving Hammond avenue, Duluth, Minn., at $46,000.

The Youngstown, O., Street Railway Company will be compelled to pave their tracks with brick.

F. Butts, City Engineer of Kansas City, Mo., wants bids until September 23 for paving sundry streets.

Proposals are invited until September 20 for paving North Fifth street, Reading, Pa., with Trinidad sheet asphalt.

The Minneapolis, Minn., council has been asked to pave Stevens avenue, from Grant to Lake street, with cedar blocks.

The Manistee, Mich., city council has ordered the paving of part of Arthur street, to cost about $4,000. Contract not let.

Contracts have been awarded to the Southern Construction Company, of Chattanooga, Tenn., for paving sundry streets.

John Hadley, of Canton, O., has a contract for paving Walnut street, in New Lisbon, O., with brick, and curbing with stone, at $29,000.

An ordinance has passed the Minneapolis council for paving with cedar blocks parts of Cedar avenue, Third street, Fifth and Sixth streets.

Col. Robinson is to macadamize Maple avenue, Elmira, N. Y., and will pave the south approach to the Lake street bridge with vitrified brick.

Citizens of the town of Fremont, Wash., have asked the commissioners to allow $10,000 for the completion of a boulevard around Lake Union.

George Hoxie, Chas. Beard and others are organizing a stock company, to construct toll road from Fresno, Col., to Pine Ridge, to cost $25,000.

J. R. Ferguson, city clerk of Evansville, Ind., wants bids until September 29, for improving sundry streets by grading, curbing, and paving with brick.

At Toledo, Ohio, the contract for paving Maumee avenue with Medina stone has been let to the Claflin Paving Company and John R. Miller, at $22,519.

The Arnold Improvement Company, of Evansville, has a contract for the improvement of East Oak street, between Thomas and Silver streets, at Louisville, Ky.

The contract for paving Becker avenue, West Superior, Wis., has been let to J. O'Connor, at $30,280, and P. J. Murtaugh for paving Thompson avenue, at $21,984.

Proposals will be received at the Bureau of Provisions and Clothing, Navy Department, until September 16, for furnishing the New York navy yard broken stone and cement for "The Concord and Bennington." Edwin Stewart, Paymaster-General, U. S. Navy, may be addressed.

The St. Paul, Minn., Board of Public Works has let the contract for paving Maria avenue, from Bates avenue to E. Seventh street, to Walter C. Doherty, at $27,499.

At Columbus, O., a contract has been awarded to C. L. Kurtz, of the Buckeye Paving Company, for the paving of Woodruff avenue and High street to Doe Hallett, with rock asphalt.

The Cedar Rapids, Iowa, council has accepted the report of the committee on paving, recommending that city streets be paved with brick. F. A. Simmons, W. P. Brady, Jos. Zbenak, committee.

At Detroit, Mich., J. A. Cook has a contract for paving Napoleon street; R. M. Adams for paving Sherman street; T. J. Kennedy for Twenty-fourth street, Michigan avenue; and Archibald Grant for John R. street.

At West Superior, Wis., Kiever & Burke have the contract for grading, curbing and paving Broadway from Oak to Plow avenue at $34,287. Also for paving and curbing Ogden avenue from First to Belknap street, at $38,507.09. Gleason Bros. & Rughie have the contract for grading, curbing and paving Bay street, from D street to Stinson avenue, at $82,274.

At Duluth, Minn., J. J. C. Davis has a contract for grading three streets, at $14,800; A. H. Truax, for grading Second, Third and Norton avenue, at $15,148; A. & D. Sand, curbing six streets, at $13,416.50; John Grant, paving Centre avenue, at $15,900, and graveling Lisbon avenue, $1,750; Thompson & Jeffery, graveling Second avenue, W., at $2,200, and Porter Bros., graveling Norton avenue, at $2,223.

Water-Works.

Earlville, Ill., will issue bonds for the construction of water-works.

Paw Paw, Mich., will build a 2,000 barrel reservoir for the water-works.

The Lynn, Mass., councils have appropriated $75,000 for a water supply.

Heppner, Ore., will vote on issuing bonds for the construction of water-works.

At Lake Forest, Ill., $30,000 has been subscribed for the construction of water-works.

Northern capitalists may put in a $100,000 system of water-works at Milledgeville, Ga.

Santa Ana, Cal., has voted to issue $60,000 bonds for the construction of water-works.

At Cedar Rapids, Iowa, a stand pipe system has been selected for water-works to cost $7,000.

Citizens of White Sulphur Springs, Mont., will organize a water-works company with a capital of $100,000.

At Spokane Falls, Wash., the Cannondale Water Company has been incorporated. Capital, $20,000.

Water Valley, Miss., will vote September 29th on issuing $10,000 bonds for the erection of electric light plant and water-works.

The Cortland Water-Works Company has been awarded the contract for building a new water-works plant at Gouverneur, N. Y.

The Chambersburg, Pa., town council has determined upon a site for its new water-works and a committee has been appointed to carry out the action of council on an increased water supply.

John Foley, E. N. Olmsted and W. A. Healey, of New Hampton, Iowa, are the committee on constructing new water-works.

City Engineer Jungerman, of Covington, Ky., has made plans for the reconstruction and repair of the reservoir, at a cost of $28,000.

The Milwaukee, Wis., board of public works has let one contract for laying the pipes for the new water-works to Schuyler & Schinglau, of Chicago, for $35,000.

San Antonio, Texas, will vote on a proposition by Col. Breckenridge to sell the water-works and river front to the city for $2,000,000, payable in fifty year 5 per cent. bonds.

J. G. Banning, A. A. Ward and A. K. Lane, of Brockfield, Mo., have been appointed a committee to visit neighboring towns to ascertain the cost and mode of construction of water-works.

The Castle Rock, Wash., Water-Works Company has been organized to supply the city with water, and will build a reservoir and dam. The latter will cost about $30,000. P. W. O'Brien, president.

Arrangements have been made to furnish the city of New Larado, in Mexico, just across the line, with a supply of water by means of a system of water-works to be run in connection with those in Larado, Texas.

A special council committee has been investigating the quality and quantity of water supplied by the Monongahela Water Company for the people of the south side of Pittsburgh. It is complained that water taken from the Monongahela river is impure.

Two water companies for Millersburg, Pa., have been chartered—the Millersburg Home Water Company, capital $20,000, E. H. Leffler, manager; the Millersburg Water Company, capital $25,700, J. G. M. Bay, Harrisburg, manager.

James Brown, City Comptroller of Allegheny, Pa., wants bids until October 1, for construction of complete water-works plant, containing two pumping engines, capacity, 8,000,000 gallons each; two reservoirs, also stop gates, boilers, filtering plant, conduit and force mains.

It is thought that the Brooklyn, N. Y., Board of Aldermen will adopt the report of the Water and Drainage Committee authorizing the city water-works commissioner to expend $700,000 in constructing distributing mains to relieve a scarcity of water in specified districts.

Bridges.

The North street bridge, at Milwaukee, Wis., will be constructed at a cost of $25,000.

At Marble Falls, Texas, a bridge will be built over the Colorado river, to cost $20,000.

J. H. Parks, of St. Joseph, Mo., has been awarded contract for iron bridges by the county court, to cost $6,914.

The Board of Supervisors has passed the bill to build an iron bridge across Hampton river at Hampton, Va.

The Wheeling, W. Va., Terminal Company has just been chartered, its purpose, it is stated, being to build a double steel railroad bridge from Bridgeport, Ohio, to Wheeling.

The M. C. R. R. will probably be required to construct bridges over their tracks in the western part of Detroit.

The Louisville & Nashville Railroad may build a bridge across Kentucky street, Louisville, between Eighth and Eleventh.

The Kansas City, Mo., Board of Public Works has recommended the construction of a bridge over Turkey creek, to cost $4,500.

The Kansas City, Mo., council is considering the question of the construction of a viaduct across the Santa Fe yards, on Goddard avenue.

At Scranton, Pa., an ordinance has passed the Select Council, providing for the issuance of bonds for the purpose of building bridges in sundry locations.

When the street work is finished on Forty-ninth street and Woodland avenue, Philadelphia, it is proposed to build a bridge over the Pennsylvania railroad tracks.

The New Jersey Steel and Iron Company has contracts for building the Myrie Run bridge, the Mercer and Somerset Junction bridge, and the Scutter's Mill bridge.

J. H. Higley, of Fort Scott, Kan., has the contract for the approaches for the bridge being built across the Missouri river by the Kansas City Bridge and Terminal Railway Company.

Bridge President Howell, of Brooklyn, N. Y., says, "No plans for the terminal improvement of the Brooklyn Bridge have as yet been submitted to the Board of Experts by outsiders, although there are frequent inquiries regarding the work."

The contract for building the iron viaduct from the northern terminus of Fifth street, to Chestnut Hill, Richmond, Va., has been let to the Edgmoor Bridge Works, of Wilmington, Del. It will be 1,200 feet long, and 40 feet wide. Cost, $72,921.

Sewers.

Lynn, Mass., will borrow $35,000 for the completion of the outfall sewer.

Ashland, Wis., has appropriated $30,000 for sewer extensions and cedar block paving.

J. E. Riley & Co. have a contract for laying sewer pipe in the village of Highlands, Col., at $42,692.80.

The Minneapolis council committee on paving and sewers has recommended the construction of sewers on several streets, to cost $47,000.

Mellin & Potter, the lowest bidders, will probably be awarded the contract for building North Main street sewer, in Rockford, Ill., at about $10,000.

The board of public works, at Jamestown, N. Y., has recommended the construction of a separate system of sewerage in that city at a cost of $95,000.

At Minneapolis ordinances have passed the council for the construction of sewers on Hennepin avenue, Fifth street, Fourteenth street, and Thirty-fourth street.

Contracts have been let for sewers on Belmont avenue, Chicago, from the river to Milwaukee avenue, to cost $30,000, and on North avenue, from Kedzie to Grand avenue, to cost $25,000.

Street Railways.

The Hinsey Company, of Milwaukee, Wis., will probably be granted a franchise on Centre avenue.

The street railway ordinance asked by F. E. Tibbett and W. A. Avery, at Ionia, Mich., has been granted.

At Davenport, Iowa, the Home Syndicate has let a contract to the Thompson-Houston Company for equipping its lines in Rock Island, Moline and Davenport, with the electric system.

The Whitefish Bay Railway Company, of Milwaukee, Wis., has been granted permit to erect poles and electric wires along the streets on which it has franchise on the east, west and south sides.

Street Lighting.

Additional electric lights have been ordered on the streets of Canandaigua, N. Y.

New bids for the electric lighting of Milwaukee will probably be advertised for.

New Albany, Ind., will substitute arc electric lights for the gas lights now in use.

The Tyler, Texas, council has just contracted for 100 additional electric street lights.

At Dubuque, Iowa, Allen & Swiney have been awarded contract for 100 arc lights, at $75 each.

The contract for lighting Laporte, Ind., by electricity has been let to the Hardins-Stahl Company, at $60 per year per light.

The Belfast, Me., Electric Light Company has been awarded the contract for lighting the streets of that city with electricity.

At Denver, Col., L. C. Parker, of Robinson, Kan., will probably establish a plant for the manufacture of gas from crude petroleum.

The Salineville, Ohio, city council has let a contract to the Edison General Electric Company for the construction of a city electric lighting plant.

The sundry civil appropriation bills contain a clause appropriating $7,700 for the lighting of the White House by electricity. The estimates submitted by Col. Ernst provide for 834 incandescent lights.

F. D. Littleheale and others have been granted a twenty year exclusive franchise for operating an electric light plant in Santa Fe, N. M. Construction of plant to begin within one year from August 11, 1890.

The Calumet Electric Lighting Company, F. H. Watrous, president, South Chicago, Ill., has secured permit to erect poles and place electric lights on all streets from Eighty-seventh to One Hundred and Sixth.

The Northern Light and Heating Company has made a proposition to the city of Minneapolis, Minn., to put a complete electric light plant in the basement of the Court House and City Hall. It will require twenty-four boilers. The plant would be used to light the entire city, as well as the building.

The Marble City Electric Light and Power Company of Rutland, Vt., has been organized, with a capital stock of $50,000. Its object is to furnish arc and incandescent lights for street and commercial use and electric power for manufacturing purposes. The stock-holders will purchase additional apparatus for the plant.

The Dover, N. J., Electric Light Company has made plans for a large increase in their plant. The estimated cost of the improvements is $15,000. At a recent meeting it was agreed that the capital stock of the company should be made $40,000, an increase of $20,000.

The franchise given by the preceding council to a company for the purpose of establishing an electric light in Frenchtown, N. J., has expired by limitation. It is now rumored that the same people are endeavoring to procure another franchise from the present council.

W. L. S. BAYLEY, C. E.

Durability, Style and Economy in the Construction of

STREETS, ROADS AND LAWNS.

ESTIMATES AND DESIGNS.

Office, 8 Lakeside Building, Residence, 324 44th Street, CHICAGO.

FOR LICENSES

To Manufacture Trinidad Asphalt Paving Blocks and Tiles and Guranteed Supply of Asphalt, complete plans for Buildings, etc., apply to

WALTER S. WILKINSON,

President International Pavement Co.

5 Chamber of Commerce, BALTIMORE, MD.

C. ALEXANDER, C. E. Mem. Can. Soc. C. E. Mem. West. Soc. C. E.
FREMONT HILL, C. E. Mem West. Soc. C. E.

ALEXANDER & HILL,

Civil Engineers

Plans and Specifications furnished for all classes of Engineering Work. Specialists on Street Paving, Sewer Construction and Municipal Work generally.

ROOM 6, No. 78 LA SALLE STREET,

Chicago, Ill.

YOU WILL MAKE NO MISTAKE

IF YOU CONTEMPLATE A TRIP TO

Chicago, Milwaukee, St. Paul, Minneapolis, or any Northwestern Point,

By purchasing your tickets over the

MONON * ROUTE

L. N. A. & C. R'Y.

The New Management having entirely rebuilt the line, putting in over 300,000 new ties, miles of new steel, new iron bridges, etc., etc. This, in connection with elegant Pullman Perfected Safety Vestibule Trains, composed of DAY COACHES, PARLOR and DINING CARS (the only line running Dining Cars between Indianapolis and Chicago), and Pullman Buffett Sleepers, makes this

THE LINE between Indianapolis and Chicago, also the Short Line, only 183 Miles Indianapolis to Chicago.

Be sure and purchase your tickets via the

GREAT MONON ROUTE.

Ticket Offices, 26 South Illinois Street, Massachusetts Avenue and Union Station.

JAMES BARKER, G. P. A., Chicago.
I. D. BALDWIN, D. P. A., Indianapolis.

..... FOR SALE .....

A Holly Pumping Engine

Capacity, 1,500,000 Gallons.

Size of steam cylinder, 10 inches; size of water cylinder, 7 1-2 inches; stroke, 21 inches; will pump against 250 feet head with the four pumps, and will lift from 23 to 25 feet; speed required for capacity stated about 33 revolutions. This engine is in good condition and will be sold at about half it would cost new.

Address, for particulars, Holly, care of

Paving • and • Municipal • Engineering

44 Chamber of Commerce, Indianapolis, Ind.

GREENCASTLE

Brick, Stone and Lime

COMPANY.

Building, Bridge, Flagging, Curbing, Stepping and Crushed Stone.

FINE PRESSED BRICK.

LIME IN CAR LOAD LOTS. Coloring Sand, Etc. Correspondence Solicited.

GREENCASTLE, IND. Works at Oakalla.

NOW READY FOR DELIVERY

THE LAW

—OF—

Roads and Streets

By BYRON K. ELLIOTT and WILLIAM F. ELLIOTT,

Authors of the Work of the Advocate.

Applicable to every City and State in the Union. Treats of the general principles of the Law of Roads and Streets. Does not deal with statutes, except in an incidental way, but discusses the general rules of law. Of the utmost importance to City Officials, Boards of Public Improvement, Contractors and all Corporations occupying Streets and Highways.

A Large 8vo. of over 800 Closely Printed Pages. Price, $6.00 Net.

THE BOWEN-MERRILL CO.

INDIANAPOLIS.

Mention this paper.

THE PURINGTON PAVING BRICK COMPANY

OF GALESBURG, ILLINOIS,

Is now building one of the most extensive and best equipped plants ever established for the manufacture of Paving Brick. D. V. Purington, of Chicago, is President of the Company. Mr. Purington is one of the foremost Brick Makers in the country. With a quarter of a century experience he has a thorough knowledge of the merits of the various DRYERS. HE HAS SELECTED FOR HIS NEW WORKS

******THE IRON-CLAD DRYER******

This Dryer will have a Drying Capacity of SEVENTY-FIVE THOUSAND per day. Mr. Purington's selection is another evidence of the established fact that for

PAVING BRICK NO OTHER DRYER COMPARES

WITH THE IRON-CLAD DRYER

For particulars see advertisement on last page of cover, and write to

THE IRON-CLAD DRYER CO., CHICAGO, ILL.

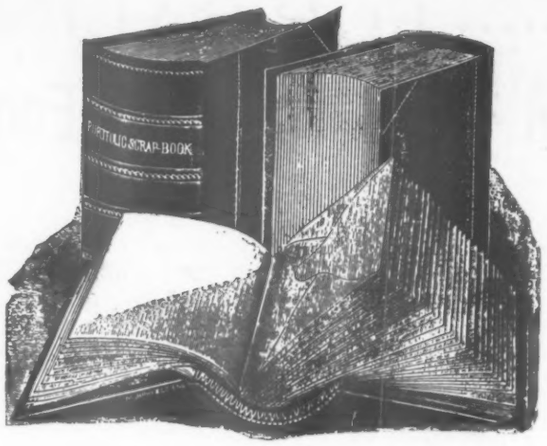
* * BREED'S * *

Patent Portfolio Scrap-Book

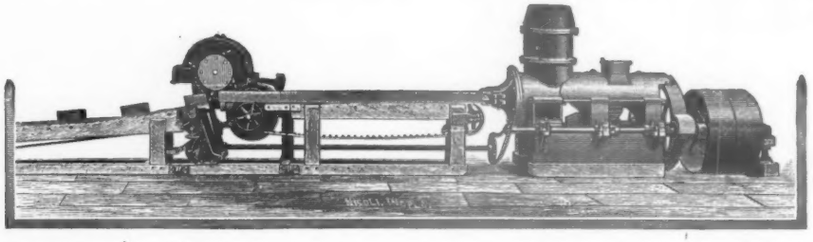
A SCRAP-BOOK WITHOUT PASTE.

The old-fashioned Scrap-book has leaves on which scraps are pasted, as collected, without orderly arrangement. Breed's Scrap-Book has pockets, or envelopes, into which scraps are dropped and methodically filed by subjects. There is no pasting, no annoyance, no loss of time, no dirt! The subject is written on the envelope containing it and entered in the index. No matter how many scraps have accumulated, all upon the same subject are together and can be easily removed, consulted and replaced. Scraps kept in this book are not blurred by pasting, defaced by exposure or mutilated by removal. Notes for editorials, sermons, lectures and other addresses can be filed here, and a record of time and place of delivery be written on the envelope. As a receptable for scraps, papers and writings, *methodically arranged for convenient reference*, it has no equal. It contains fifty heavy manila envelopes, with tuck, 6x9 inches in size, handsomely bound together in a book that stands upon an ordinary book-shelf. Half Amer. Russia, cloth sides. Price, post-paid, $3 net.

THE BOWEN-MERRILL CO., INDIANAPOLIS, IND.



THE * LITTLE * WONDER * BRICK * MACHINE



And Cunningham's Automatic

Cutting Table

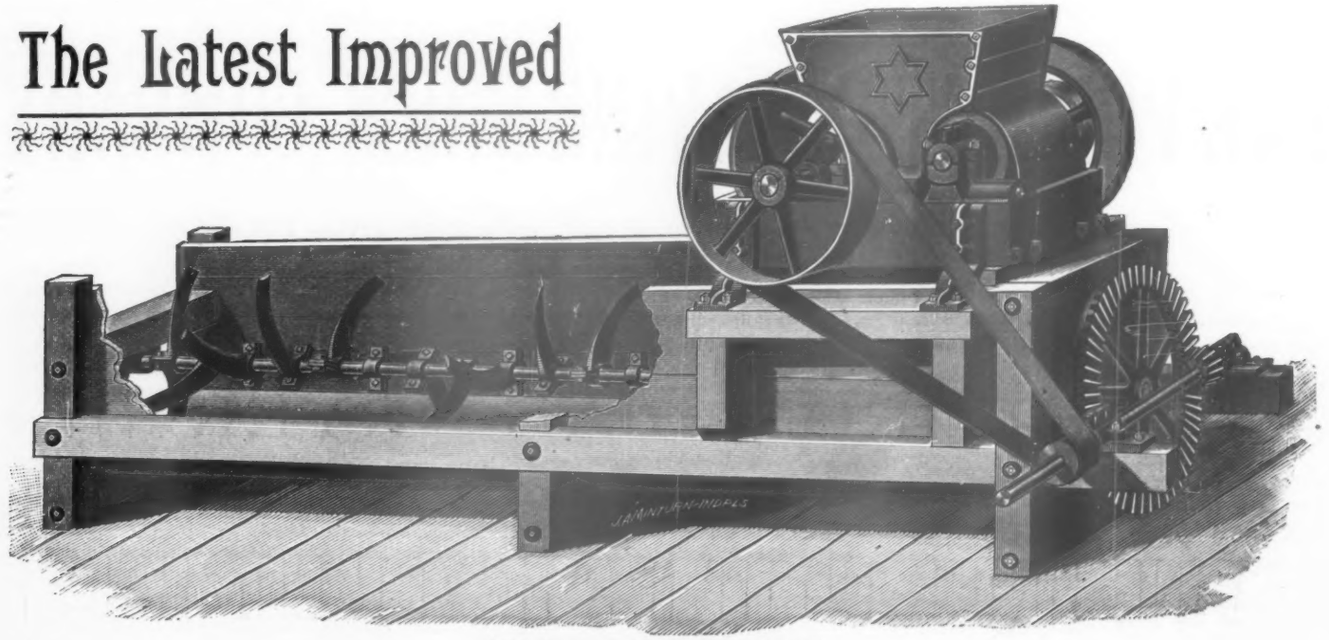
Send for Illustrated Catalogue.

Mention this Paper.

The Wallace Manufacturing Comp'y

FRANKFORT, INDIANA, U. S. A.

The Latest Improved



COMBINED PUG MILL AND DISINTEGRATOR.

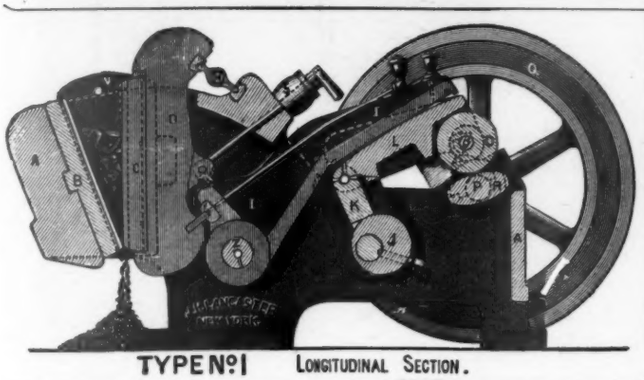
Brick & Clay Working Machinery

We are prepared to erect complete plants of any desired capacity, and keep in stock a full line of BRICK MACHINERY, PUG MILLS, DISINTEGRATORS, Mold Sanders, Clay Cars, Drums and all kinds of Brick-makers' Supplies furnished on short notice. Write for 1890 Catalogue.

C. & A. POTTS & CO., INDIANAPOLIS, IND.

THE LANCASTER ROCK BREAKER AND ORE CRUSHER

The Strongest, Simplest, Cheapest and the Most Perfect Rock Breaker Made.



TYPE No. I LONGITUDINAL SECTION.

Adjustable while running to instantly yield any desired uniform grades of product.
Half the power only required and is less liable to breakage, and less in first cost and also in subsequent wear and tear, and less weight than any rival's breaker. For crushing rock for concrete these breakers are specially efficient.
The "Lancaster" Crushers are also made in "Sections" for easy transportation in mountainous regions. May be mounted on wheels, worked by hand, horse gear and steam or other power, and also fitted with Rotary Screens, Elevators and Conveyors. Correspondence and trial tests solicited.

THE "LANCASTER"

Will automatically dig, raise and discharge minerals, such as mud, clay, gravel, sand, hard pan, ores, rock phosphates and fire-clay from their beds and banks, and also load and unload vessels or barges with sand, coal ores, grain and other materials. These Grapples are made of best forged steel, with four penetrating scoops, operated solely by compound leverage, thus dispensing with the inside sheaves, drums, catches, gears, chains and friction, found in all rival buckets. They may be worked by hand or horse-power, or by any maker's double drum hoisting engines.

Send for our new illustrated price-list, agency terms and testimonials, and make appointment to see our Rock Breakers, Grapples, Hand, Horse and Steam Power Hoisters at work. Comparison of our prices, capacities and merits with all rival Grapples, Rock Breakers, Hoisters, Etc., earnestly solicited. Licenses to manufacture granted.

☞ Correspondence solicited. Manufactured and sold by the patentee.

Self-Penetrating Grapple, Excavator and Dredger

JAMES H. LANCASTER, (P. O. BOX 3139) 169 AND 171 BROADWAY, NEW YORK, U. S. A.

THE PURINGTON PAVING BRICK COMPANY

OF GALESBURG, ILLINOIS,

Is now building one of the most extensive and best equipped plants ever established for the manufacture of Paving Brick.

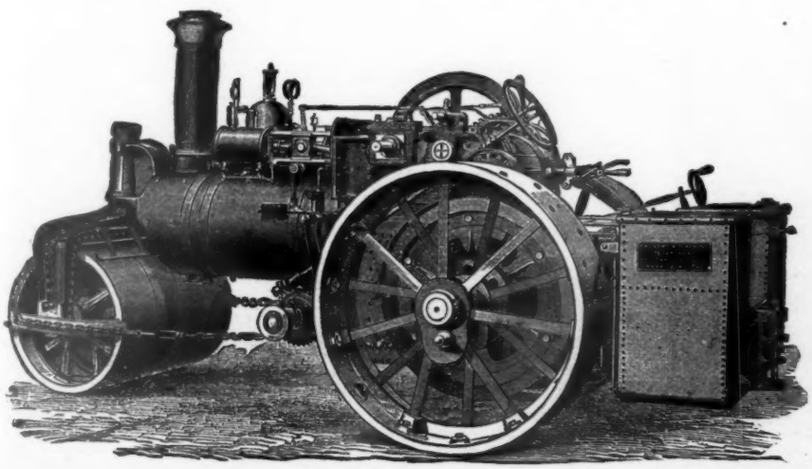
Mr. D. V. Purington of Chicago, the President of the Company, is one of the foremost brick makers in the country.

With his long experience and knowledge of the art he has selected for his new works

THE CHAMBERS BRICK MACHINES

IN HIS IRON CLAD DRYER HE WILL USE CHAMBERS'S WROUGHT BODY DRYER CARS.

It Pays to Buy the Best. See Advertisement on Last Page of Cover.



THE HARRISBURG PATENT

DOUBLE ENGINE STEEL

Steam Road Roller

Constructed of the Best Quality of Material Throughout Guaranteed Equal to any

ROLLER IN THE MARKET.

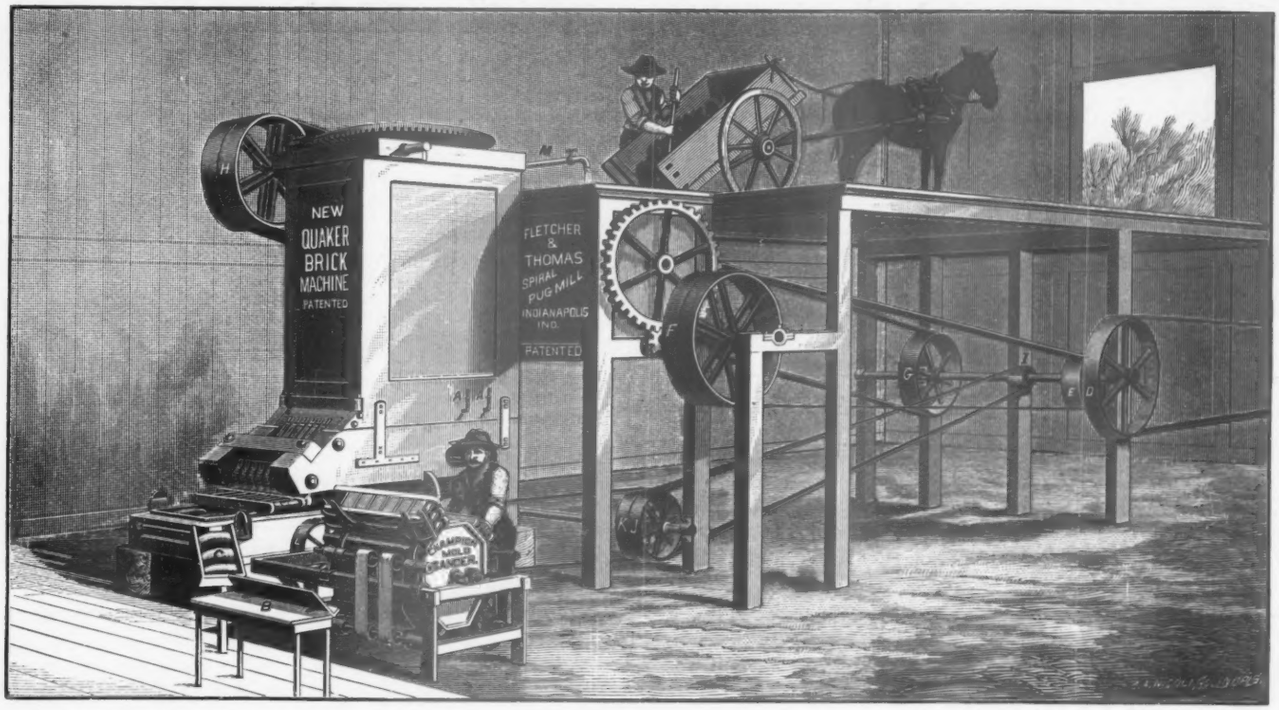
MANUFACTURED BY

Foundry and Machine Department,

HARRISBURG, PA.

SEND FOR CATALOGUE.

FLETCHER & THOMAS

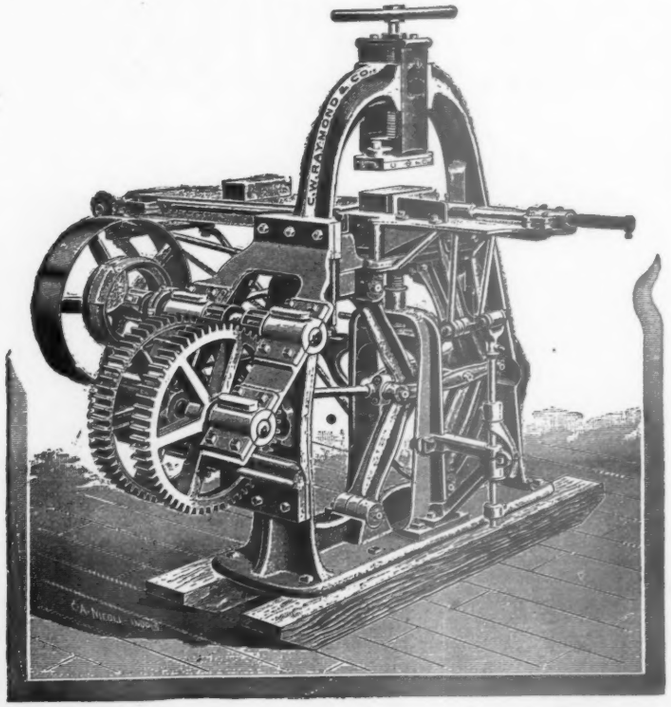


Improved Brick-Making Machinery

The above cut represents the New Quaker Complete Combined Steam Power Outfit. Capacity, 40,000 per day. Capacity of Horse-Power, 15,000 to 20,000. The most most perfect machinery for making PAVING BRICKS, FIRE BRICKS or COMMON BRICKS. We make a specialty of equipping yards complete in every detail ready for work. Send for illustrated catalogue.

Correspondence Solicited. **FLETCHER & THOMAS, INDIANAPOLIS, INDIANA.**

Raymond's Automatic Power Press



The Only Successful Re-press for Making

Paving Blocks

RED AND FIRE BRICK, ROOFING TILE, ETC.

A rapid working and powerful machine for pressing paving blocks, by which they are given great density and uniformity of size and finish. Thirty-five of these remarkable presses in daily use, making from 8 to 12 thousand finished paving blocks per day each. No first-class paving brick made without re-pressing. No plant complete without this press. Send for catalogue of paving brick machinery

C. W. RAYMOND & CO., DAYTON, OHIO.